Material and Layered Design of Thermal and Environmental Barrier Coating for Gas Turbine Hot Gas Component

Lee, Kee Sung
School of Mechanical Engineering, Kookmin University : Professor

https://doi.org/10.15017/1960657

Keynote Speakers

Kee Sung Lee
Professor, School of Mechanical Engineering
Kookmin University, Korea
Email: keeslee@kookmin.ac.kr

Short Biography

Kee Sung Lee is Professor of School of Mechanical Engineering at Kookmin University in Seoul, Korea. He received his MS and PhD degree in the department of Material Science and Engineering from KAIST (Korea Institute of Science and Technology). His post doctor career was conducted at NIST (National Institute of Standards and Technology) in Gaithersburg, U.S.A. for about 2 years as a guest researcher. He investigated the contact damage studies on the layered ceramics at NIST. He worked as a Visiting scholar at the Mechanical Engineering Department of University of Nevada at Reno in 2010. He investigated nano ceramic coating on Cu surface to increase cooling efficiency. Major research fields are ceramic engineering for mechanical and energy system, and indentation evaluations on the materials. His specific research themes are layered design and the mechanical property evaluation of thermal barrier coating and environmental barrier coating. His works also have extensively covered mechanical properties and indentation evaluations on the ceramic composites such as nanocomposites, CNT-added composite, graphene composites, dense/porous layered composites and fiber-reinforced composites. He has published more than 122 peer-reviewed papers, hold 15 registered patents, and has delivered more than 230 lectures in conferences. He serves as an executive director of the Korean Ceramic Society and Chair of Refractory Ceramic Division of the Korean Ceramic Society.

Material and Layered Design of Thermal and Environmental Barrier Coating for Gas Turbine Hot Gas Component

Abstract

The operating temperature of the gas turbine is continuously increasing for high energy efficiency and fuel saving, thus high thermal resistance and high durability of material are required for hot gas component. Particularly, as a component material to be affected by a high combustion temperature, thermal insulation coating by ceramics is indispensable for a combustor liner or a turbine blade in the power plant and the aircraft industry. However, repeated exposure to heat at high temperature and low temperature during cooling may cause delamination of the coating material due to stress mismatch between the sublayer and the coating layer, so that the durability of the coating material needs to be improved. For insulation, a coating material having a low thermal conductivity is preferable, and therefore, it is desired to increase the lifetime by stacking on the commercial coating materials. In addition to heat resistance, high mechanical and fatigue resistance are required for high temperature gas turbine parts. Therefore, a multilayer coating structure having excellent durability not only in terms of thermal properties but also in mechanical properties is suggested. In the second part, we discuss the applicability of silicon carbide fiber reinforced silicon carbide composites to turbine components to resist high heat-resistant temperatures. However, when silicon carbide is applied, there is a problem that mass reduction can be caused by oxidation or corrosion when exposed to a high temperature, especially in a steam atmosphere. Therefore, in this study, the thermal and mechanical properties of the environmental coating material are introduced and the results of the study will be presented. We have been conducting research with Professor Jang of Kyushu University and will continue to carry out collaborative research in the future.